Soil Sampling Results from Areas Northwest and South of the North Campus of Montana Tech of The University of Montana Butte, Montana

by

Montana Bureau of Mines and Geology

February 2006

Summary

A total of seventy-four soil samples were collected and analyzed for metals content from three areas adjacent to the Montana Tech North Campus. These areas comprise a proposed land transfer between BP/ARCO and Montana Tech. The purpose of the sampling was to assess the potential liability of mine wastes remaining from historic mining activities, since this area is part of the EPA's Westside Soils Operable Unit Superfund Site.

Samples from most of the land under consideration showed no exceedences of any metals standard. All of the exceedences were confined to waste piles located in the westernmost portion of lands under consideration. Here, 16 samples exceeded all the lead standards for exposure, and 8 of those 16 samples also exceeded one or more of the arsenic exposure standards. These samples represent 7 of the 20 waste piles sampled, or approximately 35% of the sites. However, the percentage of land represented is much smaller. None of the waste piles with elevated arsenic and lead concentrations is large; volumes range from less than 10 cubic yards to perhaps as much as 100 cubic yards.

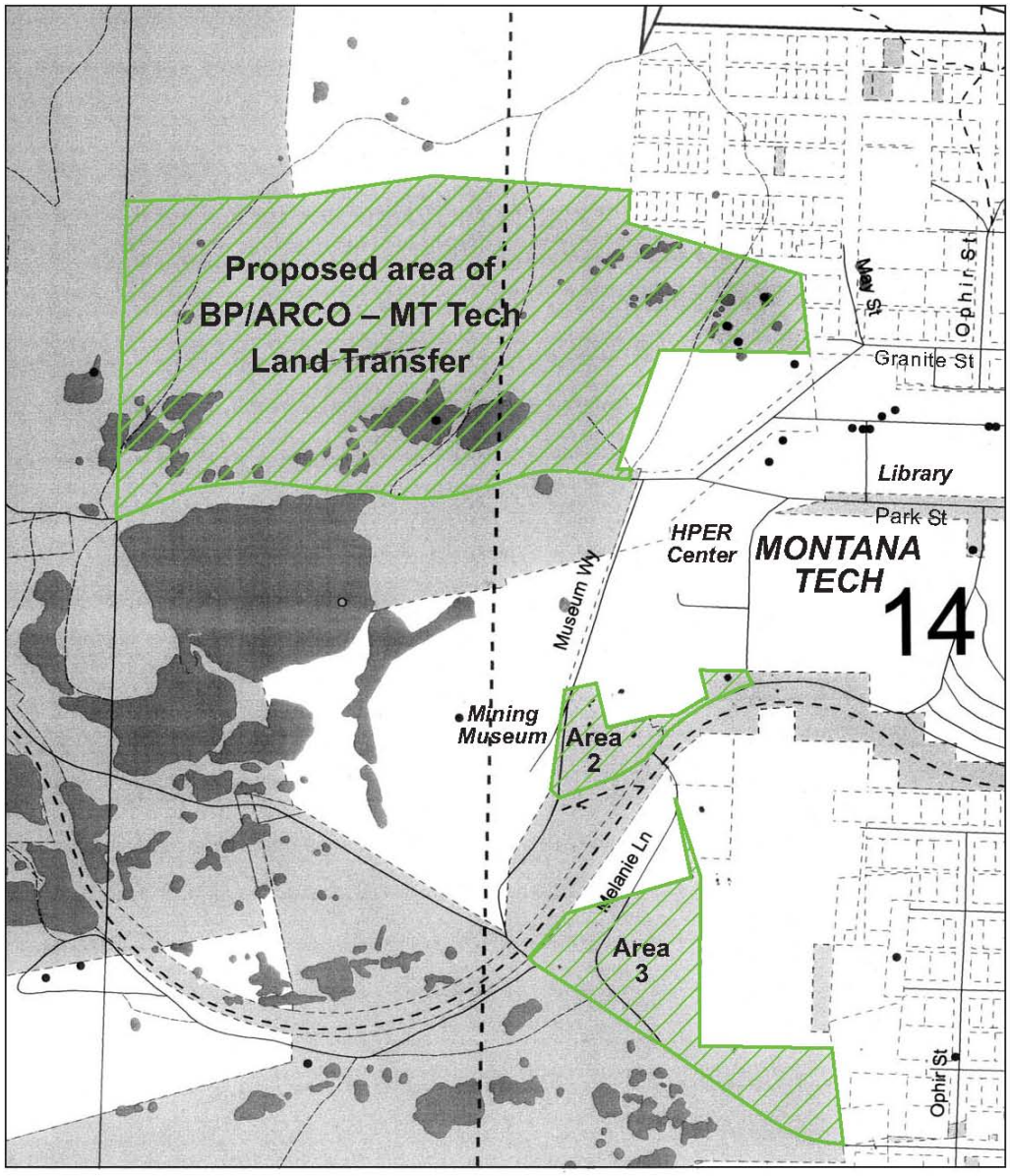
To preclude future environmental liability to MT Tech, the area with the waste piles that exceed standards could be excluded from the land transfer, or the smaller piles could be moved and consolidated with other wastes nearby or hauled to the Butte Mine Waste Repository located north of the Berkeley Pit.

If these limited areas of contaminated material were excluded (or the waste removed), their should be no potential environmental liability associated with the land transfer for MT Tech and the State of Montana as the remaining arsenic and lead concentrations are well below the EPA guidelines.

Introduction

A large portion of the area west of the Montana Tech campus is owned by the British Petroleum/Atlantic Richfield Company (BP/ARCO) which is interested in transferring ownership to other parties. Montana Tech is interested in several parcels that abut the campus and are shown on the attached map (fig. 1). Two

parcels (fig. 1, areas 2 and 3) are relatively small and are adjacent to the HPER practice field and south of the former Day Care building and the Welding Lab.



Map showing the three areas of the proposed BP/ARCO MT Tech land transfer.

Figure 1. Location map showing the three areas of potential land transfer between BP/ARCO and MT Tech.

The other, much larger piece of property (fig. 1, area 1) lies to the northwest of the HPER and west of the proposed building site for the new Natural Resources Building. A number of small waste piles dot area 1 and are associated with small surface prospects, or glory holes. Several waste piles near the western border of area 1 are larger but do not appear to have prospect diggings adjacent to them.

The entire area lies within the Butte Area/Silver Bow Creek Superfund Site and is part of as the Westside Soils Operable Unit. This area is considered a Superfund site due to the presence of mine wastes from historic mining activities. Notable mines that are adjacent to the study area are the Orphan Girl and Orphan Boy, which are located to the south of the area 1 parcel.

To assess the potential environmental liability that might exist with the various waste areas, the Montana Bureau of Mines and Geology (MBMG) conducted a detailed soil sampling of the majority of waste piles in the area of the proposed land transfer. Where several waste piles were adjacent to one another and the material in the piles were similar in appearance, only the largest pile was sampled. Due to snow cover and snow drifts, some of the very small piles were not locatable and therefore not sampled. Prior to beginning the soil sampling, a letter was sent to the U.S. Environmental Protection Agency (EPA) and the Montana Department of Environmental Quality (MDEQ) with a description of the sampling plan. The sampling plan followed the procedures used during the Butte Priority Soils Operable Unit (BPSOU) investigations. (Copies of correspondence are included in Appendix 1). EPA and MDEQ made visual inspections of the area and subsequently provided a letter approving the sampling plan.

Description of Sampling Activities

The sampling plan followed protocol established for the BPSOU investigations. While the EPA protocol collects samples only from the 0 to 1-inch depth interval, this sampling project also included a composite sample collected from 0 to 12 inches. This additional sample was collected to better characterize the waste pile at depth. Each waste area was assigned a unique field number, i.e. WP-1, prior to sampling.

Samples from each waste area were collected using the EPA 5-point “X” configuration. Based upon the size of the waste pile, an “X” was made on the face of the pile. In most cases, the “X” was at least three feet by three feet (3’ x 3’) which represented a large area of the waste pile face. Due to the weather conditions, the material in the waste piles were snow-covered and frozen, therefore, it was necessary to use a pick and shovel to dig 1-foot deep holes at the tips of the “X” and in the center. Once the five holes were dug, samples of material were scraped off the inside of the hole from the two respective sample intervals using a stainless steel spoon and placed into separate stainless steel bowls. The material was then thoroughly mixed (composited) and placed in closable Ziploc plastic bags, properly labeled with the field number, sample interval and sample date. Coordinates for each sample site were recorded using a hand-held GPS unit; site locations are shown on figure 2.

Samples were collected from four additional sites (areas 2 and 3 shown on figure 1) located along the southwestern corner of the MT Tech Campus. Field numbers (i.e., DC and HP) were used to distinguish these sites from the mine waste locations. The area around these sites consisted of a grassed, open-area practice field and weed-covered native soils. Since there was uncertainty about possible fill material underneath the grass areas or if mine waste was ever deposited and removed from the other area, soil samples were collected not only for the 0 to1-inch and 0 to12-inch intervals but also from the 12 to 36-inch and 36 to120- inch intervals. Samples from these locations were collected using a Mobil B-50 auger drill rig. Samples were collected off the drill augers for each interval using a stainless steel spoon and bowl. Samples were then handled in a manner similar to that described above for the waste piles.

Sampling equipment was cleaned using a stiff-bristle, plastic brush and wiped with clean paper towels between each sample. All sampling equipment was thoroughly washed at the start of each day also.

Samples were delivered to the MBMG lab where they were dried, digested, and analyzed by ICP and ICP/MS following EPA Method 200.7 for arsenic, cadmium, copper, iron, lead, and zinc.

Figure 2. Sample Sites on Lands Proposed for Transfer to Montana Tech

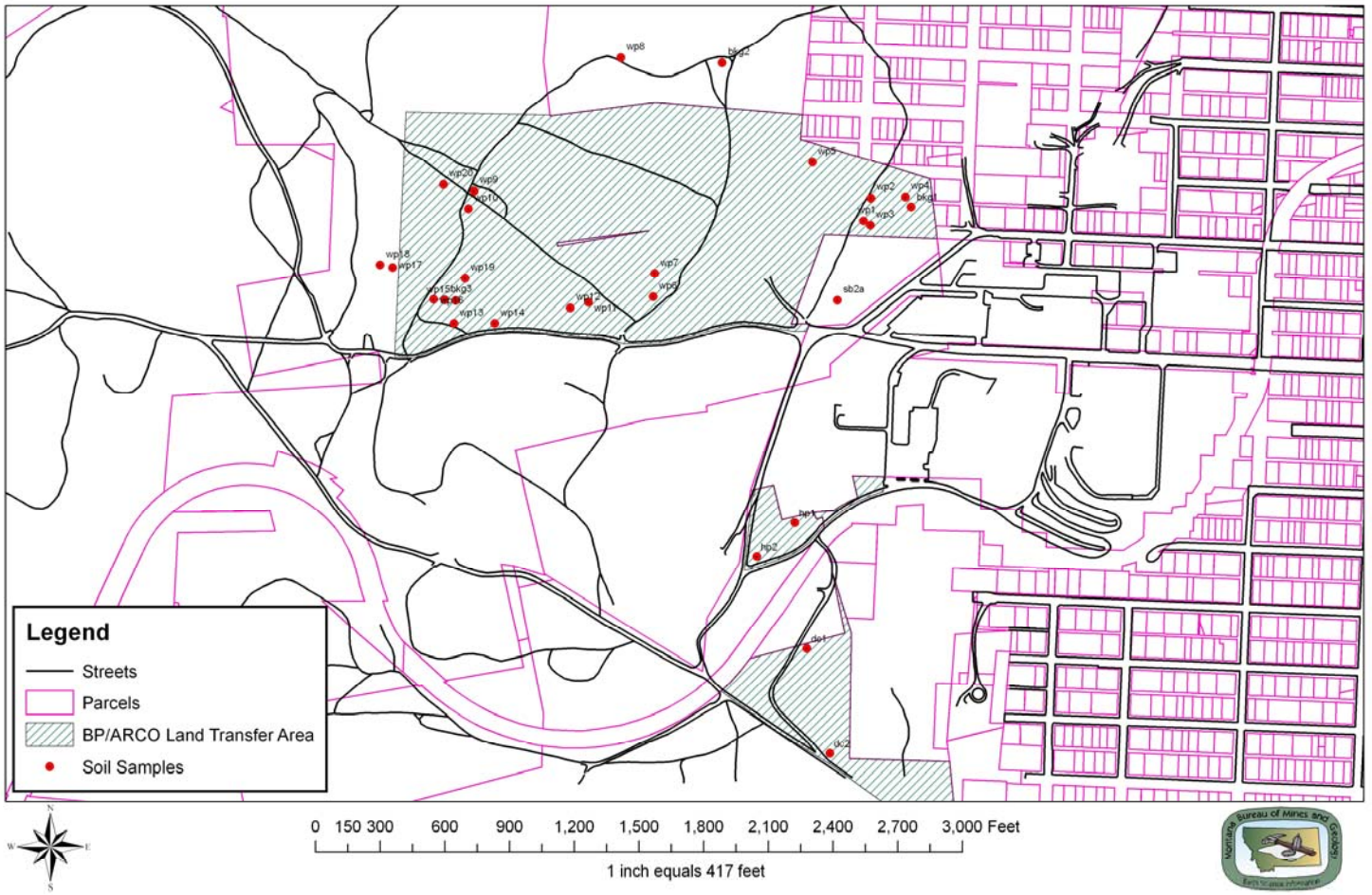


Figure 2.

Sample Results

A total of seventy-four samples from twenty-nine different locations were collected and analyzed. These samples include blanks, duplicates, and background samples. Results from all samples are contained in Appendix 2.

Only two of the six analytes, arsenic and lead, have well established exposure standards. These standards are those established by EPA for the BPSOU. While only two analytes have exposure standards the other four analytes are used to assess overall environmental conditions and potential impacts to vegetation and from runoff on surface water bodies. Table 1 shows those standards and the number of samples exceeding the standards.

Table 1. Arsenic and lead soil standards and number of exceedences.

	Category	**Standard (ppm)**	**Number Exceedences**	**Number Sites**
Arsenic	Residential	250	8	4
	Commercial	500	1	1
	Recreational	1000	0	0
Lead	Residential	1200	16	7
	Commercial/Industrial/ Recreational	2300	16	7

Based upon the information contained in Table 1, lead is the primary analyte that exceeds the EPA-recommended standards. The arsenic exceedences occurred only in samples that had lead exceedences. When a sample exceeded the standard in the 0 to1- inch interval, it was exceeded in the 0 to 12-inch sample.

Table 2 summarizes sample results by sample area/type, i.e. waste pile, blank, etc. All the exceedences occurred in samples collected from the waste piles in the western part of area 1. The seven waste piles with exceedences are WP-6, 7, 11, 14, 15, and 16 and are shown on figure 3. These sites had more

manganese-bearing rock associated with the pile and several waste areas did not appear to have adjacent surface diggings. It is possible that this material might have been hauled into these sites and does not represent native (natural conditions) materials.

Table 2. Sample statistics by source area/sample type.

		As	Cd	Cu	Fe	Pb	Zn
Sample blanks	Mean	<2	<0.2	5.3	2,548	3.3	19.8
	Min	<2	<0.2	4.8	2,461	2.9	13.3
	Max	<2	<0.2	5.7	2,634	3.6	26.2
Background samples	Mean	30	0.67	55	6,913	59	97
	Min	8.6	0.29	5.9	1,251	12.8	28.4
	Max	71	1.09	167	12,384	106	177
Waste piles	Mean	124	7.32	95	15,472	2,411	1,502
	Min	4.8	0.25	5.8	4,446	19.2	37.4
	Max	501	57.2	483	34,810	11,793	14,930
HPER	Mean	11	1.41	56	10,328	45	218
	Min	2.3	1.05	8.5	4,350	6	43.4
	Max	27.8	1.91	103	12,963	158	619
Day Care	Mean	6.7	0.41	11.5	9,883	16	67
	Min	2.1	0.31	5.2	7,611	2.1	31.9
	Max	19	0.51	30	12,282	52	182

All concentrations are in mg/kg or parts per million (ppm).

The average lead concentration in the waste piles exceeds the highest (2,300 ppm) standard for human exposure, however, if the samples from the seven waste areas with exceedences are removed, the average concentration is 145 ppm with a maximum concentration of 825 ppm. These levels are well below the lead standard established for residential areas.

Figure 3. Location of Soil Samples with Lead and/or Arsenic Exceedences of EPA Standards

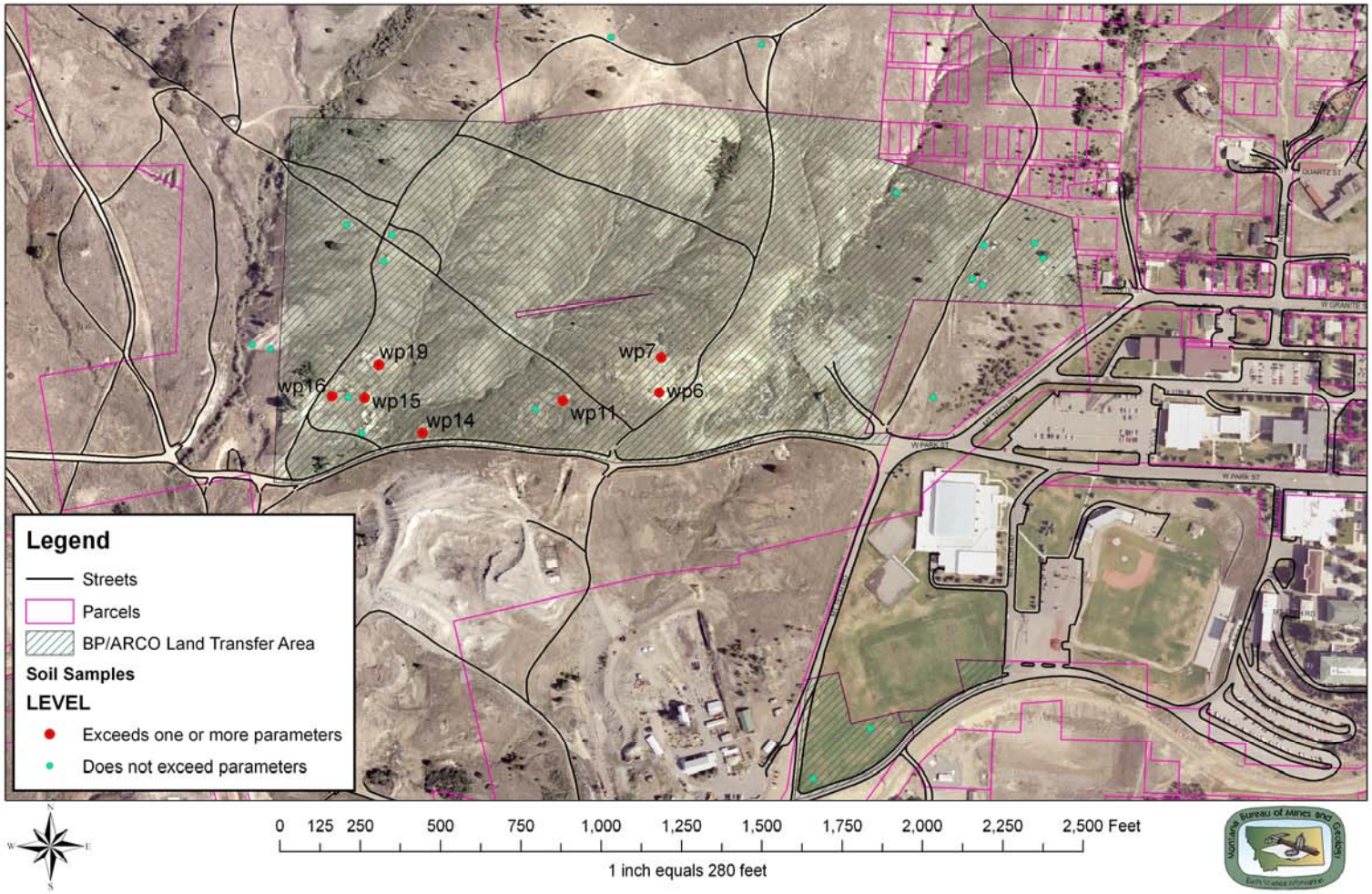


Figure 3

Conclusion

Soil samples were collected and analyzed for selected trace metals from three areas adjacent to the MT Tech campus that are part of a potential land transfer between BP/ARCO and MT Tech. No arsenic or lead exceedences were found in samples from two of the three areas, whereas exceedences for one or both of those analytes were noted in 35% of the samples collected from waste piles located northwest of the MT Tech campus.

Arsenic and lead exceedences were more common in waste piles in the western portion of the area. The seven waste piles with elevated arsenic and lead range from small to medium (1 to 10 dump truck loads, based upon 10 cubic yard trucks) in size. The areas with these piles could either be excluded from the land transfer, or the waste could be removed. Either option would eliminate the potential environmental liability of the land transfer. The arsenic and lead concentrations in the remaining areas are below the EPA limit for residential areas while the proposed usage of the land in the exchange areas would be a combination of commercial and recreational which have even higher concentration limits. Therefore, there should be no environmental liability from metals contamination in the areas of the proposed land transfer.

Appendix 1

Correspondence with EPA and DEQ

MontanaTech
MONTANA BUREAU OF MINES AND GEOLOGY

COPY

December 6, 2005

Ms. Sara Sparks
USEPA
155 W. Park
Butte, MT 59701

Mr. Joe Griffin
MDEQ
PO Box 200901
Helena, MT 59620-0901

Dear Sara and Joe:

I would like to thank you for your time spent discussing the proposed soil sampling on lands west of Montana Tech of the UM (MT Tech) campus. Herein details the reasons behind this sampling and provides a brief discussion of the proposed sampling plan for your review and comment.

British Petroleum/ Atlantic Richfield Co. (BP/ARCO) and MT Tech have been discussing the transfer of a portion of BP/ARCO's property to MT Tech. The property is mainly northwest of the MT Tech campus and is part of the Westside Soils Operable Unit. The areas of interest to MT Tech are shown on the enclosed map.

Before requesting approval for this transfer from the Montana University System Board of Reagents, MT Tech must identify any potential liabilities on this property. Our goal is to identify any sites on this property that do not meet the appropriate standards, and would thus result in a liability to MT Tech or the University System. MT Tech and the Montana Bureau of Mines and Geology (a department of MT Tech) are proposing the sampling and analysis of soils and waste dump material in this area following EPA protocols. There are approximately 30 small waste piles adjacent to old mine prospects (glory holes) and we propose to sample each of the piles following the EPA - 5 point "X" configuration. Samples from the surface to 1-inch depth intervals will be collected following the Clark Fork River soil sampling Standard Operating Procedures. (This interval is the EPA recommended zone for determining human health

1300 West Park Street • Butte, Montana 59701-8997 • http://mbmgsun.mtech.edu
406-496-4180 • Fax: 406-496-4451

exposure.) In addition, we will collect composite samples from the 0 to12-inch depth interval to further characterize these wastes should they be disturbed or moved in the future. Two or more samples will be collected from the larger waste piles. Random samples will be taken of the undisturbed native soil at five or six locations following the same sampling protocols. Duplicate and blank samples will also be collected and analyzed from this area. Samples will be analyzed by EPA Method 200.7 for arsenic, cadmium, copper, lead, and zinc.

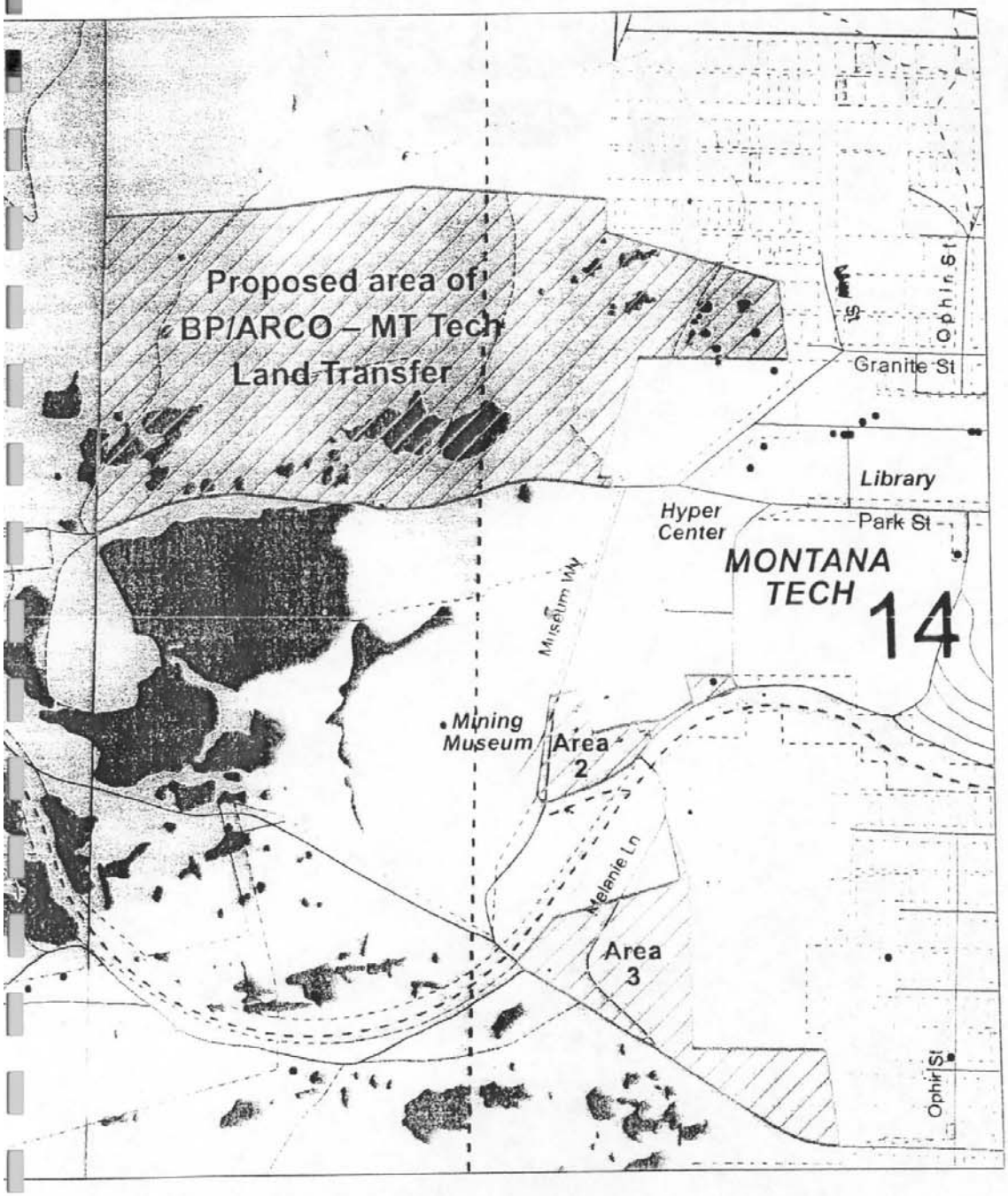
There are two other small areas to the south that we will also be sampling at the 0 to 1-inch depth interval (see the attached map). However, at these two sites we are planning to collect drill (core) samples to a depth of 10-ft to characterize any fill material in the area. Composite samples will be collected and analyzed for the depth intervals of 0-1 ft, 1-3 ft, and 4-10 ft.

We want to ensure the sampling is sufficient to preclude any need for additional future characterization. However, we realize that if waste piles are disturbed, additional sampling may be necessary in those areas. I would appreciate any suggestions, comments, or concerns EPA and DEQ might have concerning the proposed work. Any improvements that would help minimize future legal conflicts would be welcome. Feel free to contact me if you would like to discuss this work in more detail. I appreciate your time and effort reviewing this brief description and look forward to your response.

Sincerely,

Ted Duaime
Hydrogeologist

TD:pd
Enclosures
xc: Ed Deal, MBMG
Frank Gilmore, MT Tech



Map showing the three areas of the proposed BP/ARCO–MT Tech land transfer.

aime, Ted

rom: Sparks.Sara@epamail.epa.gov
nt: Wednesday, December 14, 2005 8:08 AM
Duaime, Ted
ubject: Re:

: Joe and I went out and looked at the area. doesn't seem to have much mine waste--just as you had told me. I will get letter. The sampling you propose is exactly what we use in the BPSOU. Thanks Sara

a Weinstock Sparks
edial Project Manager
PA
W. Granite Street
te, MT 59701
782-7415
(406) 782-3838

2006

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8, MONTANA OFFICE
FEDERAL BUILDING, 10 W. 15th STREET, SUITE 3200
HELENA, MONTANA 59626

Ref: 8MO

December 16, 2005

Mr. Ted Duaime
Montana Bureau of Mines and Geology
1300 West Park Street
Butte, MT 59701-8997

Re: Sampling Plan for land West of Montana Tech

Dear Ted:

The U.S. Environmental Protection Agency and the Montana Department of Environmental Quality has reviewed your proposed sampling plan for the property west of Montana Tech. The sampling plan you have proposed is exactly what is used for the BPSOU. The Agencies approve your proposed sampling plan.

If you have any questions or concerns, please call me at (406) 782-7415 or Joe Griffin at (406) 841-5042.

Sincerely,

Sara Weinstock Sparks
Remedial Project Manager

Joe Griffin
Project Manager

Appendix 2

Soil Sample Results

Appendix 2
Montana Bureau of Mines and Geology
Soil Sampling Data

Montana Tech Soil Sampling
BP/ARCO Land Transfer

Site ID	Sample Interval (in)	Description	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Pb (mg/kg)	Zn (mg/kg)
		EPA Standards	**(250,500, 1000)**				**(1200, 2300)**	
SB-2A	0-1	Sample collected off auger	21.9	0.34	73.5	9,711	21.0	67.6
SB-2B	0-12	Sample collected off auger	5.7	<0.2	18.8	6,358	61.8	70.1
DC-1	0-1	Coarse brown and gray weathered granite	5.9	<0.2	13.8	9,126	10.6	54.6
	0-12	Coarse brown and gray weathered granite	5.8	0.31	15.6	8,383	19.4	64.5
	12-36	Coarse brown and gray weathered granite	2.1	<0.2	7.0	11,968	4.7	40.6
	36-120	Coarse brown and gray weathered granite	2.7	<0.2	5.3	11,006	2.8	32.3
DC-1D	0-1	Duplicate sample of DC-1	4.8	<0.2	13.4	8,211	13.4	53.6
	0-12		6.3	0.32	17.9	7,611	22.1	81.5
	12-36		<2	<0.2	6.1	9,967	2.4	36.2
	36-120		2.8	<0.2	5.15	11,377	2.8	31.9
DC-2	0-1	Gray weathered granite	9.5	0.44	30.4	8,136	49.3	182.0
	0-12	Gray weathered granite	18.5	0.51	9.2	9,739	52.3	132.0
	12-36	Gray weathered granite	9.5	0.47	7.1	10,794	13.6	57.4
	36-120	Coarse brown and gray weathered granite	5.3	<0.2	7.6	12,282	2.1	41.7
HP-1	0-1	Sod, top soil	21.7	1.91	96.2	9,810	44.0	286
	0-12	Brown soil	3.2	1.31	14.5	9,155	158	459
	12-36	Light brown weathered granite	2.3	<0.2	8.5	12,153	10.4	54.0
	36-120	Weathered granite, hard at 8.5 ft	<2	<0.2	8.7	12,430	6.0	48.4
HP-2	0-1	Sod, top soil	10.3	1.38	89.5	4,350	43.6	619
	0-12	Soil with weathered granite	27.8	1.05	103	8,986	75.1	163
	12-36	Brown and gray weathered granite	7.4	<0.2	63.6	12,773	17.7	67.6
	36-120	Brown and gray weathered granite	3.8	<0.2	62.7	12,963	7.2	43.4
WP-1A	0-1	Waste rock	8.8	0.36	55.4	7,582	27.4	65.1
WP-1B	0-12	Waste rock	20.8	0.53	77.6	7,735	39.4	78.8
WP-2A	0-1	Waste rock, broken weathered granite	4.8	0.35	32.7	5,962	21.9	57.0
WP-2B	0-12	Waste rock, broken weathered granite	5.0	<0.2	29.6	5,330	19.2	44.6
WP-3A	0-1	Waste rock, broken weathered granite	51.0	2.48	169	5,801	86.3	151
WP-3B	0-12	Waste rock, broken weathered granite	75.4	0.94	145	6,752	75.4	104
WP-4A	0-1	More soil, clay, roots. Waste rock.	49.7	1.30	158	5,635	71.0	113
WP-4B	0-12	More soil, clay, roots. Waste rock.	48.8	0.82	111	5,140	57.3	89.4
BKG-1A	0-1	Soil with roots	70.5	0.99	167	7,160	77.3	113
BKG-1B	0-12	Broken rock, small amount of soil	56.0	1.09	126	7,592	50.6	100

Appendix 2
Montana Bureau of Mines and Geology
Soil Sampling Data

Montana Tech Soil Sampling
BP/ARCO Land Transfer

Site ID	Sample Interval (in)	Description	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Pb (mg/kg)	Zn (mg/kg)
		EPA Standards	**(250,500, 1000)**				**(1200, 2300)**	
WP-5A	0-1	Large dump	15.0	1.39	51.5	9,293	134	363
WP-5B	0-12		11.7	2.01	34.7	11,296	134	439
WP-6A	0-1	Yellow weathered waste dump, considerable quartz and pyrite on surface	206	10.80	52.2	26,511	**2,874**	3,329
WP-6B	0-12	Manganese waste mixed with weathered granite	110	9.89	63.7	20,565	**2,025**	3,130
WP-6AD	0-1	Duplicate of WP-6A	159	8.08	57.0	21,844	**3,342**	2,688
WP-6BD	0-12	Duplicate of WP-6B	147	7.93	65.3	24,910	**5,227**	2,570
WP-7A	0-1	Brown waste rock with manganese waste rock on surface	193	19.90	193	19,815	**4,762**	5,211
WP-7B	0-12	Brown waste rock	202	18.60	234	23,738	**5,457**	4,990
WP-8A	0-1	Brown waste rock with manganese waste rock on surface	50.8	0.36	61.4	4,446	43.2	37.4
WP-8B	0-12	Brown waste rock with manganese waste rock on surface	62.9	<0.2	54.6	4,824	61.9	42.7
BKG-2A	0-1	Light brown sand	10.2	<0.2	9.9	1,251	16.6	30.4
BKG-2B	0-12	Light brown sand	8.6	<0.2	5.9	1,478	12.8	28.4
WP-9A	0-1	Weathered granite	26.9	0.88	20.2	14,585	174	235
WP-9B	0-12	Weathered granite	19.2	0.25	20.8	15,857	27.6	136
WP-10A	0-1	Weathered granite, with some clay and vegetation	25.6	1.69	21.7	12,901	89.4	255
WP-10B	0-12	Weathered granite, with some clay and vegetation	28.1	0.94	21.6	14,517	66.8	195
WP-11A	0-1	Weathered granite, with some clay and vegetation	117	2.89	129	14,093	**7,597**	1,094
WP-11B	0-12	Weathered granite, with some clay and vegetation	99.3	3.60	140	12,057	**7,813**	978
WP-12A	0-1	Manganese waste mixed with weathered granite, brown coarse sand	34.7	4.45	94.7	15,541	825	1,317
WP-12B	0-12	Manganese waste mixed with weathered granite, brown coarse sand	34.7	5.77	85.2	15,177	284	1,802
WP-13A	0-1	Gray weathered-oxidized granite, clay	32.6	<0.2	6.8	18,720	66.0	1,321
WP-13B	0-12	Finer material, less large rock at depth	26.6	0.44	8.4	16,128	67.7	1,275
WP-13AD	0-1	Gray weathered-oxidized granite, clay	30.6	<0.2	6.7	19,180	56.0	1,312
WP-13AB	0-12	Finer material, less large rock at depth	30.1	<0.2	5.8	18,482	115	1,391
BLK-1		Blank, MT Tech road sand	<2	<0.2	4.8	2,634	2.9	26.2
BLK-2		Blank, MT Tech road sand	<2	<0.2	5.7	2,461	3.6	13.3
WP-14A	0-1	Brown coarse material, manganese waste on surface, lot of rock	**370**	57.20	361	34,810	**11,651**	4,333
WP-14B	0-12	Brown coarse material, manganese waste on surface, lot of rock	**300**	33.30	284	26,566	**8,985**	3,180
WP-15A	0-1	Oxidized weathered orange-brown	**395**	1.17	59.7	20,076	**4,867**	986
WP-15B	0-12	Yellow, some clay at depth	**501**	<0.2	55.4	19,802	**3,193**	796
BKG-3A	0-1	Brown sand, some vegetation	18.3	0.29	13.3	12,384	106	135
BKG-3B	0-12	Weathered granite, coarse at depth	15.8	0.29	8.7	11,613	93.0	177

Appendix 2
Montana Bureau of Mines and Geology
Soil Sampling Data

Montana Tech Soil Sampling
BP/ARCO Land Transfer

Site ID	Sample Interval (in)	Description	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Pb (mg/kg)	Zn (mg/kg)
		EPA Standards	**(250,500, 1000)**				**(1200, 2300)**	
WP-16A	0-1	Oxidized weathered gray-brown-orange sand	**485**	<0.2	85.5	13,745	**6,079**	270
WP-16B	0-12	Manganese waste mixed in pile	**469**	<0.2	81.6	12,069	**5,689**	274
WP-17A	0-1	Gray oxidized material	27.2	<0.2	12.8	16,920	551	60.4
WP-17B	0-12	Weathered granite, larger rocks at depth	16.7	<0.2	8.5	15,550	273	55.4
WP-18A	0-1	Gray oxidized material	59.6	0.85	11.7	20,605	293	340
WP-18B	0-12	Weathered granite, larger rocks at depth	72.8	1.11	12.6	20,840	241	378
WP-19A	0-1	Manganese rock and waste, weathered granite with clay	**349**	35.50	483	28,487	**10,655**	14,930
WP-19B	0-12	Manganese rock and waste, weathered granite with clay	**443**	11.80	461	27,531	**11,793**	5,474
WP-20A	0-1	Decomposed weathered granite	19.5	0.72	31.8	8,976	138	152
WP-20B	0-12	Decomposed weathered granite	16.7	0.47	23.6	10,364	31.1	63.2
Mean*			83.0	5.41	70.2	12,765	**1,447**	938
Maximum*			**501**	57.20	483	34,810	**11,793**	14,930
Minimum*			2.1	0.25	4.8	1,251	2.1	13.3
Number*			70	48	74	74	74	74
Number of Exceedences			**8**				**16**	

* Statistics do not include values <DL.

Site Identifiers
SB-Soil Boring
DC-Day Care
HP-HPER Field
WP-Waste Pile
BKG-Background
BLK-Blank